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Title: Overview of PFAS at LANL

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Overview of PFAS at LANL

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Outline

14-May-2020

Overview of PFAS at LANL

DOE PFAS Working Group Meeting

Los Alamos
NATIONAL LABORATORY
EST. 1943

- What are the potential uses and sources of PFAS at LANL?
- What are the emerging issues?
- What are federal and state agencies doing regarding PFAS?
- Where are we monitoring PFAS at LANL?
- What are the preliminary findings of PFAS monitoring?
- What do the data suggest?
- Where do we go from here?

Potential uses and sources of PFAS at LANL

Potential Uses

- AFFF*
- Surface active agents*
- Metal plating processing*

LANL is not a large PFAS user

- Not a fluorochemical manufacturer
- Not a AFFF training facility
- Not a chrome plating facility

Potential Sources

- Chemistry and Metallurgy Research Facility*
- Sigma Complex
- Plutonium Processing Facility effluents transferred to the RLWTF*
- Waste Water Treatment Plants*
- Cooling tower water from TA-03*
- Manhattan Project liquid waste discharges*
- Cold War Era liquid waste discharges
- Consumer products – e.g. paints

*Reference: 2019, NMED, DOE Oversight Bureau. Project Quality Assurance Project Plan on PFAS Monitoring at LANL and Vicinity

PFAS is an emerging issue nationwide

Cannon Air Force Base

One source of PFAS groundwater contamination in New Mexico

A team of firefighters battle a petroleum fire during a live-fire training exercise at Hurlburt Field, Fla. (Photo: Tech. Sgt. Sam King / US Air Force)

What States are doing about PFAS

- 2016: the EPA issued a non-regulatory Health Advisory of 70 parts per trillion for PFOA and PFOS in drinking water
- Currently no federal regulation on groundwater, surface water, wastewater, or solids
- Some states have been creating their own regulations on PFAS
- NMWQCC in Dec 2018 added 3 PFAS to the Groundwater Toxics List

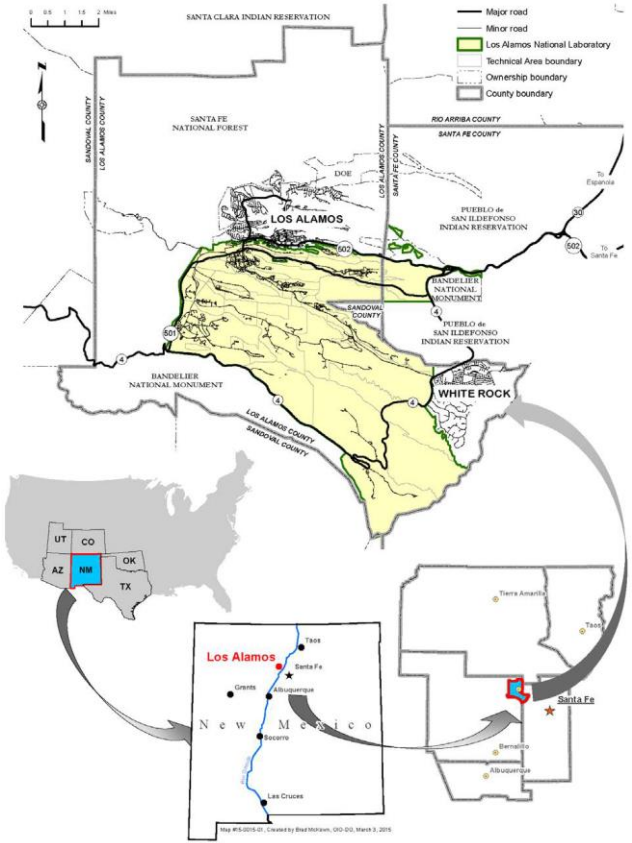
Location setting of LANL

- Los Alamos National Laboratory established 1943
- 47 Technical Areas
- ~12,000 employees
- Situated on Pajarito Plateau
- Approximately 40 sq. mi.
- >2,600 buildings
- Elevation ranges from ~7800 feet on west to ~6200 feet on east
- Fingerlike mesas separated by deep east-to-west-oriented canyons
- Most Laboratory and community developments are confined to the mesa tops
- The Rio Grande runs east of the Laboratory and forms part of the Laboratory boundary

Location setting continued

Primary Watersheds

- Los Alamos
- Pajarito
- Sandia
- Water
- Chaquehui
- Mortandad
- Ancho



PFAS monitoring and communication at LANL

Monitoring

NMED DOE Oversight Bureau

- Ground water, soil, sediment, and biota (FY20 and prior)

N3B (Los Alamos Legacy Cleanup Contractor)

- Ground water and surface water (FY20)
  - Required by NMED

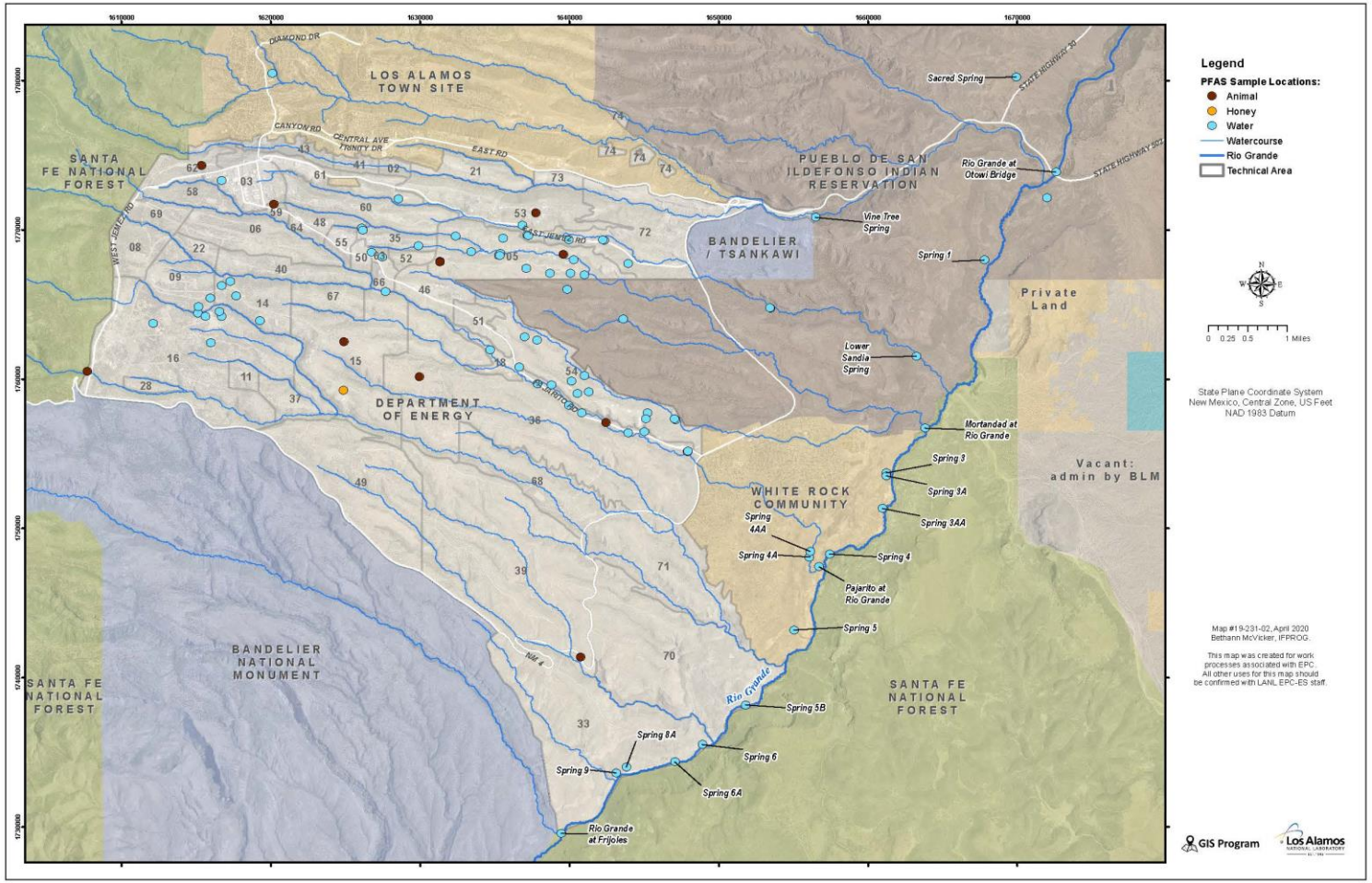
Triad (M&O contractor for LANL)

- Effluent from Rad Liquid Waste Facility (FY20)
  - Required by NMED- started 1st quarter of FY20
- Pollution Prevention (FY20)
  - SWWS – influent, effluent, compost, and solids
  - Not a requirement yet
- Soil, Foodstuffs, and Biota monitoring program (FY19)
  - Not a requirement

Communications (technical presentations)

- Pueblo de San Ildefonso
- Santa Clara Pueblo
- Jemez Pueblo
- LANL - Legal, EPC-Management

Locations of samples collected for PFAS analyses



PFAS-containing water as a process stream

- Typically we think about AFFF being used in open-source applications like foam laydown yards, or as unused product
- But some uses of AFFF are in-between
- At LANL, testing of the automatic fire suppression system at LANL's Dual-Axis Radiographic Hydrodynamic Test facility (DARHT) generates a PFAS-containing fire suppression water
- As PFAS legislation evolves, how do we handle this process stream with compliance and stewardship?
- What are options for substitution to non-PFAS fluorine free foams (FFF)?

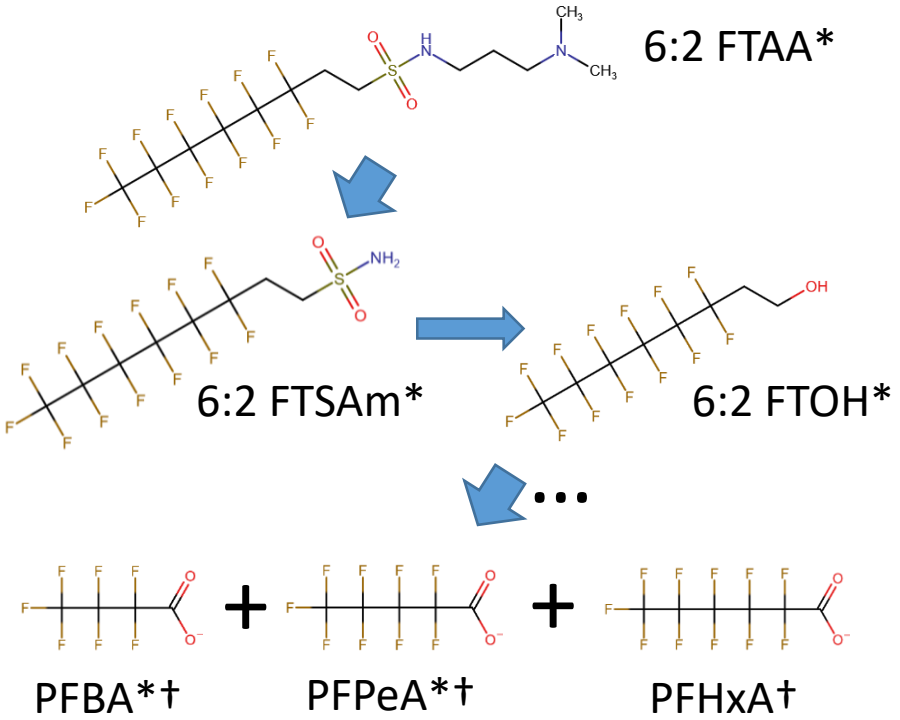
AFFF system flow in the hangar bay; USS Makin Island 2015 [CC BY-SA 2.0]

Fire suppression water at DARHT

- Responding to PFAS as an emerging contaminant, the LANL Pollution Prevention program (P2) requested the capture of fire suppression water on the presumption that it contains PFAS
- We are in process of sampling plan development for toted fire suppression water and determination of how to disposition a not-yet-regulated process stream
- However, challenges abound:
  - Suitability of analytical methods
  - Desired reporting limits versus dilution
  - How to deal with large quantities of dilute process stream

Composition of AFFF impacts analytical design

- PFAS as a family contains over 4,700 unique compounds (OECD 2018), nearly all of which are not included in EPA Method 537.1
- *PFAS precursors* can *transform* to PFAS compounds that are currently regulated:
  - National Foams AFFF, a fluorotelomer sulfonamide alkylbetaine (FtAB) formulation, oxidizes to PFCA, including PFHxA (D'Agostino and Mabury 2017)
  - Buckeye 3% Platinum AFFF, a fluorotelomer betaine (FtB) formulation, oxidizes to PFCA, **including PFOA** (Houtz et. al. 2013)
- When analyzing for PFAS, missing the precursors can underreport the total PFAS in the sample, and underestimate risk:
  - If the process stream later degrades to regulated PFAS compounds
  - And/or if the regulated list grows…



Adapted from D'Agostino and Mabury 2017

**Analyte not included in EPA 537.1*

†*Highly stable end product*

Soil, Foodstuffs, and Biota Program Objectives

- Determine whether LANL operations are impacting human health via the food chain and the environment
- Determine concentrations and distribution of:
  - Radionuclides, metals, and organic chemicals from potentially impacted areas and compare them with:
    - Regional Background (world wide fallout and natural sources)
    - Screening Levels (LANL, NMED)
    - Standards (DOE, EPA, FDA)
- Evaluate trends over time
- Calculate radiological dose and assess risk
- Primary regulatory drivers:
  - DOE order 458.1 “Radiation Protection of the Public and the Environment”
  - DOE order 231.1B “Environment, Safety, and Health Reporting”
  - State of New Mexico Environment Department Compliance Order on Consent U.S. DOE

Preliminary findings of biota PFAS results

- A total of 15 biological samples were collected and analyzed for PFAS in 2019.
- 7 non-detect samples: 1 honey sample (onsite-DARHT), 2 gopher snakes (1 from onsite, 1 from background), 3 mule deer (onsite), and 1 elk (background) .
- Birds and snakes submitted as whole body; muscle samples were collected for deer and elk.

		Analytical Results, µg/kg (ppb)								
Chemical		American Kestrel	Great-horned owl	Common Raven	Common Raven	Gopher Snake	Gopher Snake	Gopher Snake	Mule Deer	Human Blood (CDC)
Perfluorohexanesulfonic acid	PFHxS	0.547		3.35						
Perfluorohexanoic acid	PFHxA								0.400	
Perfluorooctanesulfonic acid	PFOS	4.15	1.97	6.43	2.63	0.6	1.65	1.97		4.99
Perfluorooctanoic acid	PFOA	0.367		0.938						1.94
Perfluorononanoic acid	PFNA	0.367		0.342	0.684					
Perfluoroundecanoic acid	PFUnDA		0.521	6.32	0.273					
Perfluorododecanoic acid	PFDoDA		0.557	1.67						
Perfluorotridecanoic acid	PFTrDA		1.22	33						
Perfluorotetradecanoic acid	PFTeDA		0.762	4.11			0.976			

What do the data suggest?

What do these data tell us?

- Detects could be due to:
  - Sampler contamination
  - Exogenous contamination (e.g. tires)
  - True detects
- At this point, true detects:
  - Suggest bioaccumulation
  - Cannot suggest a source
    - Need background comparisons

What do these observations suggest?

- Our observations are within the range observed in human blood
- Our observations are within the range of tissue concentrations in studies published in the literature
- Many of the locations in the literature are around non-point source pollution, suggesting our observations could be due to atmospheric transport.
- Our observations also follow the general pattern of PFAS concentrations in animal tissues
- These data do not suggest that LANL is the cause - need samples from background locations to answer this question

Where do we go from here?

What are we currently doing?

- Established robust PFAS sampling procedures for the SFB program
- For biota collections, analyze PFAS in a single tissue instead of whole body
- Need more data, both onsite and background
- FY20 PFAS SFB sampling includes:
  - Soil, sediment, and vegetation from DARHT
  - Opportunistic biota collections
  - Rio Grande and Abiquiu and Cochiti Reservoirs sediment, crayfish, and fish
- Further investigations of LANL uses and sources and review of NMED data

Upcoming Regulatory Issues

- Short-term: groundwater discharge permits (DP1132/DP857 Issuance/renewal discharge permits)
- UCMR 2022: Maximum Contaminant Level (MCL) process for PFOA and PFOS
- Additional PFAS added to analytical suite with lower detection limits

Questions and contact information

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